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THESIS

GOVERNMENT ORIENTED AND COMMERCIALLY
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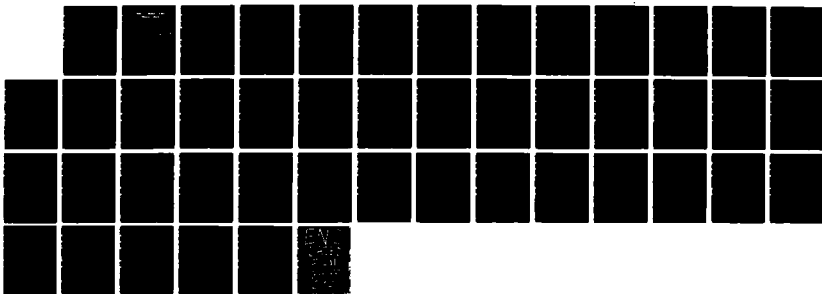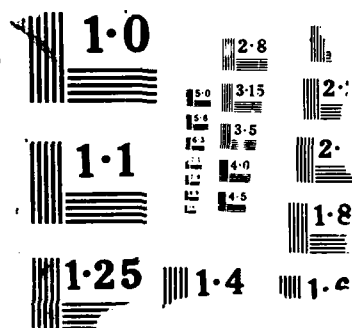DATA AND ANALYSIS

by

Susan Valerie Viscovich

December 1987

Thesis Advisor: Dan C. Boger

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This thesis investigates the relationship between Department of Defense oriented corporations and commercially oriented corporations, along with the government and commercially oriented business segments of these same corporations. The data elements of backlog, net sales, operating profits, and identifiable assets are examined, and the methodology for deriving these data elements from the SEC 10K reports in their total and segmented forms is explained. The analyses of variance on the unsegmented data elements determined no difference between corporation groups, however analyses of segmented data elements resulted in significant variations. Segmented data appears to be necessary to explain the variations due to either type of corporation or time period.

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1

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Segments of Corporations: Data and Analysis

by

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Lieutenant, United States Navy
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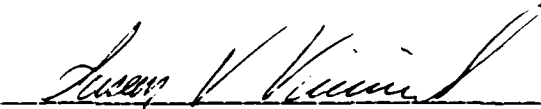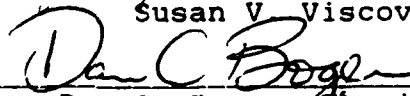requirements for the degree of

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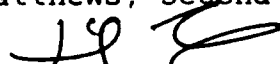Susan V. Viscovich

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2

ABSTRACT

This thesis investigates the relationship between Department of Defense oriented corporations and commercially oriented corporations, along with the government and commercially oriented business segments of these same corporations. The data elements of backlog, net sales, operating profits, and identifiable assets are examined, and the methodology for deriving these data elements from the SEC 10K reports in their total and segmented forms is explained. The analyses of variance on the unsegmented data elements determined no difference between corporation groups, however analyses of segmented data elements resulted in significant variations. Segmented data appears to be necessary to explain the variations due to either type of corporation or time period.

TABLE OF CONTENTS

LIST OF TABLES

5

I. INTRODUCTION

A. PURPOSE

There have been many studies conducted over the past thirty-five years examining the profitability of defense oriented firms. These firms have been examined, utilizing different methods to compare them with commercial firms. This scrutiny developed as a direct result of charges levied by both the news media and members of Congress of grossly inflated profits taken by defense contractors in their dealings with the Department of Defense. The expressed attitude was that this resulted in an unfair and unnecessary burden upon the taxpayer. Yet, many of these studies have received widespread criticism for "biased premises, nonrepresentative samples, inaccurate data and misleading variations in statistical averages." (Ref. 1:p. 10) There is still virtually no agreement about whether defense oriented firms are receiving undeserved higher profits than their commercially oriented counterparts.

The Defense Financial and Investment Review (DFAIR) was initiated in response to recommendations made by the Grace Commission in 1983. The mission of the DFAIR was to "study contract pricing, financing and profit (markup) policies to determine if they are resulting in effective and efficient spending of public funds and maintaining the viability of the

6

defense industrial base, and to make recommendations for improvements." (Ref. 2:p. E-1) In general, the DFAIR analysis concludes that these current policies are economically balanced, protecting the taxpayers' interests and enabling U.S. industry to achieve an equitable return for its involvement in defense business. (Ref. 2:p. IX-2) Although the DFAIR attempts to deal objectively with these matters, the question of how to compare defense contractor profitability with that of their commercial counterparts remains yet to be resolved. Martin's study, An Empirical Assessment of Defense Contractor Risk 1976-1984 sought to factor in risk as a regulator of profit, while Louk's A Pragmatic Assizement of Defense Contractor Risk, Profitability and Debt: 1976-1984 strove to expand on this theme. Louk examined the Hurdle model and adapted it for analysis of defense versus commercial firms while measuring risk, profit, and debt.

The purpose of this thesis is to further expand upon the comparison of defense and commercial firms in search of a profitability comparison measure. The financial statements of individual companies will be examined for four data elements; backlogs, net sales, operating profit, and identifiable assets. The Security Exchange Commission (SEC) 10K reports for each company are the source of all raw data. These data will also be broken down further, into the defense

7

and commercial segments of these same four data elements within companies.

This study is structured to answer two primary questions. The first is to determine whether differences in financial structure exist, comparing the four basic data elements in Department of Defense (DOD) oriented companies to non-Department of Defense (Non-DOD) oriented companies. This analysis will then be extended to an examination of the defense and commercial segments of the four data elements within these same companies. The second question examines whether differences exist over the time period of the study for these same data elements and segments. Both questions deal with the same data base, so as to facilitate comparisons and also serve as reference points for further research.

B. OVERVIEW

In order to understand the derivation of segmented data from the 10K reports, Chapter II describes the methodology utilized for each corporation and discusses the problems encountered. This chapter also defines important terminology. Chapter III contains a review of analysis of variance procedures and the empirical analysis of the data. The various findings are outlined and their derivation explained. Chapter IV discusses and summarizes the findings from the preceding chapter and presents the conclusions.

II. DATA AND METHODOLOGY

A. GENERAL

This chapter outlines the methodology for deriving the overall and segmented data for the firms examined in this study. In selecting companies for comparison, Louk's A Pragmatic Assizement of Defense Contractor Risk, Profitability, and Debt: 1976-1984 provided an initial list of 37 corporations. These companies were divided into two groups, consisting of 13 Department of Defense (DOD) oriented firms and 24 non-Department of Defense (Non-DOD) oriented firms. Those companies attributing less than 30 percent of their total net sales to the Department of Defense were considered non-DOD oriented firms, while those companies deriving more than 30 percent of net sales from the DOD were defined as DOD oriented firms. The two groups of firms considered in this study are contained in Tables 1 and 2. [Ref. 3:p. 18]

B. TERMINOLOGY

The following terms are utilized throughout the course of this study and will be defined here so as to avoid any confusion in terminology:

DOD ORIENTED FIRMS

   These firms are determined to have greater than 30 percent of their total net sales attributable to sales to

9

the Department of Defense. Where the National Aeronautics and Space Administration (NASA) was a customer, these figures were included as part of the DOD sales. The percentages of DOD net sales were usually drawn directly from the SEC 10K reports. For companies where it was not directly provided, this figure was determined by dividing the DOD net sales by the total net sales for a given year. This was done for each year of the study, then these figures were averaged, thus providing the percentage of DOD net sales for the entire time period for a given company.

NON-DOD ORIENTED FIRMS

These firms were determined to have less than 30 percent of their net sales directly attributable to Department of Defense sales. Where this figure was not directly available from the 10K reports, the method utilized is the same as for DOD oriented firms.

BUSINESS UNITS

These refer to the groupings within companies or corporations which are used for accounting and/or marketing purposes. Although individual companies refer to these by various names, such as groupings, segments, divisions, components, etc., only this term will be utilized throughout the study for consistency.

DATA ELEMENTS

These are the four specific financial factors under study; net sales, operating profits, backlogs, and identifiable assets.

CYCLE

The time period of the study is divided into two parts to test for recessionary effects. Cycle 1 is 1977 to 1980; Cycle 2 is 1981 to 1984.

TYPE

This refers to the company's orientation; either DOD or non-DOD.

SEGMENT

Defense and Commercial segments are the divisions between data elements within companies.

10

TABLE 1

SAMPLE OF 10 DOD ORIENTED CORPORATIONS

COMPANY	ABBREVIATION
Fairchild Industries, Inc.	FEN
General Dynamics Corporation	GD
Grumman Corporation	GQ
Lockheed Corporation	LK
Martin Marietta Corporation	ML
McDonnell Douglas Corporation	MD
Northrop Corporation	NOC
Raytheon Company	RTN
Rockwell International Corporation	ROK
Todd Shipyards Corporation	TOD

TABLE 2

SAMPLE OF 14 NON-DOD ORIENTED CORPORATIONS

Company	Abbreviation
Boeing Company	BA
Emerson Electric Company	EMR
FMC Corporation	FMC
Gould, Inc.	GLD
Harris Corporation	HRS
Hercules, Inc.	HPC
Honeywell, Inc.	HON
RCA Corporation	RCA
The Signal Companies, Inc.	SGN
Singer Company	SMF
Sperry Corporation	SY
Teledyne, Inc.	TDY
Textron, Inc.	TXT
United Technologies Corporation	UTX

SEGMENTED DATA

The four data elements of net sales, operating profits, backlogs, and identifiable assets are broken into defense and commercial segments for each company or corporation.

C. ALTERATIONS IN THE DATA BASE

This study was originally intended to analyze the same corporations and categories as Louk during the identical time period of 1976 to 1984. However, upon detailed examination of the individual SEC 10K reports, it became apparent that several deviations would be required.

First, several companies were incorrectly categorized as non-DOD oriented when in fact, their net sales to the Department of Defense significantly exceeded the 30 percent cutoff. Although a few of these corporations were ultimately rejected due to lack of segmented data, the remainder were recategorized as DOD oriented firms. The recategorized companies included Fairchild Industries with an average 57 percent DOD net sales, and Todd Shipyards Corporation with an average 78 percent DOD net sales. Companies incorrectly categorized as DOD oriented companies included Boeing Company with 28.4 percent, FMC Corporation with 24.1 percent, and United Technologies Inc. with 28.2 percent DOD net sales. Several companies were clustered around the 30 percent cutoff including Singer Company with 28.75 percent, and Harris Corporation with 28.4 percent of DOD net sales. Although the 30 percent cutoff was an arbitrary choice made in earlier

studies, it was decided to retain this cutoff point and reclassify Boeing Company, FMC Corporation and United Technologies Corporation as non-DOD oriented, with Fairchild Industries and Todd Shipyards Corporation being reclassified as DOD oriented. This will maintain some consistency for later research efforts utilizing this data.

Another problem encountered was a lack of specifically segmented data within several corporations. That is, although totals for the data elements might have been provided, there was no breakout of defense or commercial subtotals for these data elements. In many cases, segmented data were available directly from the 10K reports. However, in cases where such segmented data were vague or unsubstantiated, these corporations were dropped from further consideration. All but one of these eliminated companies, Sanders Associates Inc., were non-DOD oriented firms. The deleted firms included AVCO Corporation, Control Data Corporation, E-Systems Inc., General Electric, Goodyear Tire and Rubber Company, International Business Machines, Litton Industries Inc., Motorola Inc., Penn Central Corporation, TRW Inc., Tenneco Inc., and Westinghouse Electric Corpora- tion. The end result of these recategorizations and deletions is a distribution of 14 companies in the non-DOD oriented segment and 10 companies in the DOD oriented segment. These were listed previously in Tables 1 and 2.

14

Finally, 1976 data could not be utilized, since the reporting of segmented data did not become an SEC requirement until December 1976. Therefore, only financial reports from 1977 through 1984 had usable segmented data for analysis.

The raw corporate financial information utilized for analysis and comparison can be found in the Appendix. These data elements include the yearly net sales, operating profits, backlogs and identifiable assets for each company. These data elements are further divided into commercial and defense segments within companies.

D. DERIVING THE SEGMENTED DATA

The bulk of the research effort in this study was directed at deriving segmented data which would accurately reflect the actual distribution of net sales, operating profits, backlogs, and identifiable assets between commercial and defense segments within DOD and non-DOD companies. In several cases, this information was clearly delineated in the SEC 10K reports. However, the vast majority required painstaking examination of various corporate financial statements contained within the 10K reports to arrive at the segmented amounts. In situations where the derivation of segmented data involved significant manipulation of the available financial information, it was felt that such data might unreliably reflect the correct defense or commercial categorization, and such companies were dropped from the data

15

base. This proved to be a common problem with the non-DOD oriented firms, with nearly half of them eliminated for this reason.

This section will attempt to recreate, by company, the derivation of segmented data, particularly where these data were not clearly depicted in the 10K reports. Although some subjective analysis was applied, this was purposely kept to an absolute minimum and will be properly identified as such. Where such data are unavailable or considered unreliable, they will be listed in the data base as missing observations. Companies are listed alphabetically below, along with a brief description of the business units outlined in the financial data. The methods and calculations employed for determining the net sales, operating profits, backlogs and identifiable assets are delineated here, along with any problems encountered.

Most of these companies concluded their fiscal calender in December for accounting purposes. Although it will be noted when companies utilize a different cutoff date, it is not considered to be an influencing factor on the overall data.

BOEING COMPANY

All segmented data were derived directly from the SEC 10K reports from appropriate years with no calculations required, as segmented defense data were clearly presented. There were two business units; Transportation Equipment, and Missiles and Space. The

16

business units underwent no reclassification during the time period. Boeing averaged 28.4 percent DOD oriented net sales.

EMERSON ELECTRIC COMPANY

Emerson Electric is divided into three business units which remained consistent throughout the time period. These units are Commercial and Industrial Components and Systems, Consumer Products, and Government and Defense Products and Systems. All defense oriented data were included in the last category. Since more than 95 percent of the total net sales in this unit were made to DOD, this unit was considered totally DOD oriented for data element extraction.

Only total backlog data were available for 1981 through 1984 and no segmented backlogs were provided for the entire time period. Defense oriented net sales, operating profits, and identifiable assets were drawn from the last business unit. Emerson concludes its fiscal calender in September and averaged approximately 10 percent of DOD oriented sales.

FAIRCHILD INDUSTRIES INC.

There are six business units for Fairchild Industries. While these groupings were renamed during the time period examined, the defense and commercial sales distributions remained consistent, with no change in overall structure detected. These six groupings are currently Government Aerospace, Commercial Aerospace, Communications Electronics and Space, Aerospace Fasteners, Tooling, and General.

The 10K reports stated that Government Aerospace backlogs consisted exclusively of defense backlogs. Backlogs from all other segments were considered to comprise the commercial segment; although this was not specifically stated in the 10K reports, there were no references to defense sales in any of the other units. It is logical to assume that the remaining backlogs would therefore be commercial in nature. Specific numbers were provided in the 10K reports for defense segment sales, profits, and assets. Commercial segment data were calculated by subtracting defense numbers from the total in each category. Fairchild averaged approximately 57 percent DOD oriented sales.

17

FMC CORPORATION

FMC utilized five business units; Industrial Chemicals, Petroleum Equipment and Services, Defense Systems, Performance Chemicals, and Specialized Machinery. These segments remained consistent for the entire time period.

The segmented data for net sales, defense backlogs, operating profits, and identifiable assets were all clearly identified in the 10K reports. Commercial segment figures were derived by subtracting defense numbers from the total for each business unit. FMC averaged 24.1 percent DOD oriented sales.

GENERAL DYNAMICS CORPORATION

General Dynamics currently partitions its sales and services into four business units which consist of Government Aerospace, Submarines, Commercial Ships, and Other. Although there was some reclassification of business units during the time period being examined, these changes consisted of regrouping or renaming of the business units and did not affect the integrity of the data.

Segmented figures were clearly outlined in the 10K reports for all four data elements. Commercial subtotals were calculated by subtracting defense subtotals from the totals for each data element. General Dynamics averaged approximately 77 percent DOD oriented net sales.

GOULD INC.

There are four business units for Gould, consisting of Electronic Systems, Instrument Systems, Defense Systems, and Electronic Components. These units were altered several times during the studied time period, making segmented data difficult to calculate. From 1977 to 1981, Defense Systems was part of Electronics. The 10K reports provided the percentage of the total sales that the defense products comprised of the Electronics unit. However, the operating profits and identifiable assets for this same time period are listed only for the entire Electronics unit. These numbers are included in the data base but are not considered completely reliable, as they reflect a larger number than was actually attributable to defense sales. The 10K reports stated that backlogs were completely attributable to defense sales and contracts.

The 10K reports for this company displayed some discrepancies from year to year when data were compared,

due to the unaudited nature of the segmented data. Where this occurred, the more recent 10K report figures were utilized, since these figures would be most recently updated. Gould averaged approximately 17 percent DOD oriented sales.

GRUMMAN CORPORATION

Grumman utilizes three business units for reporting financial information. These units are Aerospace, Information and Financial Services, and Non-Aerospace Products. These units experienced some renaming during the time period, although the data remained consistent.

Segmented data were clearly portrayed for defense and commercial data elements in the 10K reports, so no further calculations were required. Grumman averaged approximately 85 percent DOD oriented sales.

HARRIS CORPORATION

Harris utilizes five business units for reporting purposes. These consist of Information Systems, Lanier Business Products, Communications, Semiconductors, and Government Systems. This company experienced no significant unit changes and with this configuration all data were available directly from the 10K reports. Harris concludes its fiscal year in June for accounting purposes and averaged 28.4 percent DOD oriented sales.

HERCULES INC.

There are three business units utilized by Hercules. These are Specialty Chemicals, Aerospace, and Engineering and Fabricated Products. These units remained consistent throughout the entire time period.

Backlog figures were available for the complete period, however backlogs existed only from 1982 to 1984. Net sales for both defense and commercial segments were derived directly from data in the 10K reports. There was no clear breakout of either operating profits or identifiable assets, so the Aerospace unit figures for these data elements were utilized. This method is considered reliable, since this unit was comprised of over 90 percent defense sales. Hercules averaged approximately 11 percent DOD oriented sales.

HONEYWELL INC.

This company currently has four business units, although they were labeled differently from 1977 to 1981. These are Aerospace and Defense, Information Systems, Control Products, and Control Systems. Due to the varying percentages of defense business in each unit, this was one of the more complicated companies from which to derive data. All backlogs are attributed to defense sales and contracts, while net sales for both defense and commercial segments were directly listed in the 10K reports. Operating profits were available for the business units only and no segmented defense and commercial figures were provided. Identifiable assets have been approximated through calculation of defense percentages for each unit. These defense percentages were calculated by dividing the defense sales by the total sales for each business unit and then using this percentage of assets for the defense segment. Therefore, these data may not be completely reliable. Honeywell averaged approximately 20 percent DOD oriented sales.

LOCKHEED CORPORATION

The four business units of Lockheed consist of Missiles Space and Electronics Systems, Marine and Information Systems, Aerospace, and Aerospace Support. Since Lockheed maintains an extremely high percentage of defense oriented sales and services (averaging 94 percent), lack of specific defense or commercial segmented data for operating profits and identifiable assets was not a major impediment to deriving usable data. The data elements from the Marine and Information Systems units were considered as the commercial segment, since this unit had the highest percentage of non-DOD sales, averaging 89 percent. This method, while not as accurate as an actual 10K breakout of segmented data, is considered to be the most conservative approximation available. Another aspect of Lockheed's financial reports which deserves mention is the disposition of the Tristar program. This program resulted in substantial losses in the commercial segment of the company before its discontinuation. However, these data are not included in any of the segmented data element totals.

Backlogs were totally attributable to defense sales and contracts for every year except 1984, when a small amount of commercial backlogs existed. Operating profits for defense included all units except Marine and Information Systems, as stated above. Net sales came directly from the 10K reports for both defense and commercial segmented

data.   Assets were calculated in the same manner as
outlined for operating profits.   Lockheed averaged
approximately 94 percent DOD oriented sales.

MARTIN MARIETTA CORPORATION

This company utilizes four business units for financial
data which include Aerospace, Basic Products, Data
Systems, and Aluminum.

Backlogs were defense oriented for all business units.
Segmented data for net sales and operating profits were
directly listed in the 10K reports. The defense segment
of identifiable assets included the entire Aerospace
business unit.   There were small amounts of defense sales
in the other business units, however, these segment
percentages were not material.   Although specific
breakouts of segmented data would be preferable, this
method is believed to provide usable data.   Martin
Marietta averaged approximately 51 percent DOD oriented
sales.

MCDONNELL DOUGLAS CORPORATION

The four business units consist of Combat Aircraft,
Transport Aircraft, Space, and Information Systems.
Although these units have undergone some renaming, this
has not affected the integrity of the data during the
time period.

The defense segmented data elements of net sales,
operating profits, backlogs and identifiable assets were
all specifically identified in the 10K reports.   Defense
oriented numbers were provided for each business unit, so
these were totaled and then subtracted from the overall
total to obtain the commercial segment data elements.
The only exception was 1983 and 1984 backlogs, when
specific defense segmented data were not available for
the Transport Aircraft unit.   Consequently, none of the
data from this unit were listed as defense segment data.
This exclusion should not affect the overall data
integrity, since this was the most conservative method
available.   McDonnell Douglas averaged approximately 68
percent DOD oriented sales.

NORTHROP CORPORATION

Northrop divides its interests into four business units
which are Aircraft, Electronics, Services, and
Construction.   These units remained consistent throughout
the entire time period.

The percentage of the total backlogs comprised by defense backlogs was listed in the 10K reports, as were the segmented defense net sales. However, operating profits and identifiable assets were listed by business unit only, and since there is no accurate method for calculating these segmented data, they are considered missing observations. Northrop averaged approximately 77 percent DOD oriented net sales.

RAYTHEON COMPANY

The five business units for Raytheon include Electronics, Aircraft Products, Appliances, Energy Services, and Other. These remained consistent throughout the time period, however, specific segmented data were available only for backlogs and net sales. Both operating profits and identifiable assets were listed for total business units only, and are therefore considered missing observations. Raytheon averaged approximately 39 percent DOD oriented sales.

RCA CORPORATION

RCA divided its interests into five business units which remained consistent during the reporting periods under consideration. These units are Electronics, Entertainment, Communications, Transportation Services, and Other.

All backlogs listed in the 10K reports were for defense services and contracts. Segmented net sales were available directly from the 10K reports, as were operating profits and identifiable assets. RCA averaged approximately 11 percent DOD oriented net sales.

ROCKWELL INTERNATIONAL

The business units for Rockwell consist of Aerospace, Electronics, Automotive, and General Industrial. These units provided accessible defense data, since the first two units contained defense data only.

All four data elements were drawn directly from the 10K reports with no calculations required. Rockwell ends its fiscal year in September and averaged approximately 67 percent DOD oriented net sales.

THE SIGNAL COMPANIES

Signal currently maintains three business units. Prior to 1983 there were four, including AMPEX Corporation,

22

Garrett Corporation, Mack Trucks, and UOP Inc.. Currently these are Aerospace, Electronics and Instruments, Process Technology and Services, and Engineering and Construction Services. One unit was sold off and the others are easily traceable, so there are no data inconsistencies. Segmented backlogs were listed directly in the 10K reports. Defense sales were listed as a percentage of total sales and were calculated accordingly. Operating profits and identifiable assets were not given for defense or commercial segments and since these did not make up a major proportion of the Aerospace division, they were categorized as missing observations. Signal averaged approximately 11 percent DOD oriented sales.

SINGER COMPANY

Singer utilizes six business units which are Aerospace and Marine Systems and five separate Consumer Products Groups. This first unit was completely defense oriented, so figures for net sales, operating profits, and identifiable assets were easily derived from the financial reports. Backlogs were strictly defense oriented, with no backlogs listed for any other unit. Singer averaged 28.75 percent DOD oriented sales.

SPERRY CORPORATION

This company divides itself into four units which are Computer Systems and Equipment, Guidance and Control Equipment, Farm Equipment, and Fluid Power.

The segmented backlogs and net sales were drawn directly from the financial reports, although operating profits were listed for total units only. Identifiable assets were determined by multiplying the percentage of unit defense sales by the total identifiable assets. Sperry utilizes a fiscal calender which ends in March and averaged approximately 19 percent DOD oriented net sales.

TELEDYNE INC.

Teledyne utilizes five business units which are Aviation and Electronics, Industrial, Specialty Metals, Consumer, and Insurance and Financial. These units were consistent throughout the reporting period.

Since the first unit was more than 95 percent defense oriented, these figures were utilized for the defense segment data. Operating profits, assets, and net sales all utilize Aviation unit data for defense segment data,

while no segmented backlogs were provided. Teledyne averaged approximately 20 percent DOD oriented net sales.

TEXTRON INC.

There are seven business units at Textron. These consist of Aerospace and Electronics, Specialty Consumer, Outdoor Products, Machine Tool and Precision Bearing, Engineered Fasteners, Industrial Products, and Venture Capital and Finance. These categories experienced some renaming, however segmented data remained consistent.

Segmented backlogs, identifiable assets, and net sales were directly presented in the financial reports. However, operating profits utilized the entire Aerospace unit for defense segment data. This should not adversely affect calculations, since this unit consisted of more than 50 percent defense sales. Textron averaged approximately 19 percent DOD oriented sales.

TODD SHIPYARDS CORPORATION

There were three business units utilized during the studied period. These were Construction, Repair, and Conversion. All of the sales and services in the Construction and Repair units were defense oriented, so data for these were drawn directly from the 10K reports.

All backlogs are defense related. Sales and operating profits utilized data from the first two groupings. No numbers were available for identifiable assets for any year, so these were missing observations. Todd ends its fiscal calender in April and averaged approximately 78 percent DOD oriented sales.

UNITED TECHNOLOGIES CORPORATION

This company maintains four business units for reporting purposes. These are Power, Flight Systems, Building Systems, and Industrial Products. Since there was no specific breakout of defense related data, the Power and Flight Systems units were utilized, since these both had high percentages of defense sales. Backlogs were available for defense oriented sales and contracts, as were net sales. However, for operating profits and assets, data were listed for units only, and are therefore recorded as missing observations. United averaged 28.1 percent DOD oriented sales.

24

III. EMPIRICAL ANALYSIS

A. GENERAL

This chapter consists of the analysis of the four data elements in both their complete and segmented forms. The primary method of comparison utilized was analysis of variance, or ANOVA. This form of analysis was chosen, as it provides the most effective means of comparison between the individual and interactive effects of segmenting upon the data elements of backlogs, net sales, operating profits and identifiable assets. One-way and two-way analyses of variance were utilized. SPSS-X, or The Statistical Package for the Social Sciences, was employed for the analysis of the data.

B. TECHNIQUES OF ANALYSIS

Analysis of variance is designed to test the differences between the means of several groups. Although it is not the purpose of this chapter to explain how ANOVA works, some review of this method is included in order to facilitate later analytical explanations. In the one-way analysis of variance, the test statistic is based upon the ratio of two variances, the variance between groups and the variance within groups, which follows an F distribution. [Ref. 4:p. 473] The level of significance employed for these

25

comparisons in this study is .05, or 5 percent. If the computed significance of F exceeds this percentage, then there is no significant effect detected through the analysis of variance. In contrast, if the significance of F is less than 5 percent, this is evidence that a significant difference exists between group means as a result of a particular factor's effect.

The two-way analyses of variance compare the means of two factors of interest. That is, it tests for a difference between group, or cell, means for each factor (main effects) under consideration and additionally, tests for any interacting effects between factors. [Ref. 4:p. 502]

The following arrangement of data was utilized in the three initial SPSS-X computations. The data were organized by firm name, firm type (DOD or non-DOD), fiscal year, and defense and commercial segments of backlogs, net sales, operating profits, and identifiable assets. A different format, utilized in the second set of analyses, is presented in the Appendix. This format includes the identical data. Where specific segmented data were unreliable or not available, a -1 was specified to connote this. This prevented the erroneous assumption that zero was the total amount of a particular data element.

C. ANALYSES OF VARIANCE FOR UNSEGMENTED DATA ELEMENTS

Table 3 summarizes the significance of F for the main and interaction effects of each data element for the analyses of variance, using total firm data. No significant effects were determined to exist. These first three analyses of variance are based on total corporate data for data elements, instead of segmented data elements examined in the next section.

The first analysis of variance was a one-way ANOVA, examining the relationship of each of the four data elements with type of company. The SPSS-X program was first directed to add together the segmented data for each of the data elements, creating a single total for each. The type categories were listed as Type 1 for non-DOD companies and Type 2 for DOD companies. The next step directed computation of group, or cell, means for each data element and the analyses of variance for all of these. Since this first analysis was by type, there were two means calculated for each data element, comparing the DOD components of the data element to the non-DOD components. This analysis determined that no significant differences existed between the means for backlogs, net sales, operating profits, or identifiable assets. That is, no difference in financial structure between DOD and non-DOD companies could be explained through this comparison.

27

TABLE 3

ANALYSES OF VARIANCE FOR UNSEGMENTED DATA ELEMENTS

ANOVA and Independent Variables	Data Elements	Sig of F
One-Way by Type	B; ME	.368
	S; ME	.994
	P; ME	.486
	A; ME	.942
One-Way by Cycle	B; ME	.397
	S; ME	.211
	P; ME	.420
	A; ME	.222
Two-Way by Type, Cycle	B; ME, T	.233
	B; ME, C	.379
	B; IE, T+C	.644
	S; ME, T	.966
	S; ME, C	.229
	S; IE, T+C	.648
	C; ME, T	.384
	C; ME, C	.441
	C; IE, T+C	.385
	A; ME, T	.864
	A; ME, C	.243
	A; IE, T+C	.765

B = Backlog
S = Sales
P = Profits
A = Assets

ME = Main Effects
IE = Interaction Effects

T = Type
C = Cycle
S = Segment

28

The next analysis sought to determine if differences were detectable over time. The data were aggregated into two time periods, or cycles. Cycle 1 aggregated data from 1977 through 1980, and Cycle 2 from 1981 through 1984. The purpose of this differentiation was to determine any possible effects of the 1981-1982 recessionary period. This analysis employed the same method as the first analysis. Computation of group means for each data element by cycle and the subsequent ANOVA were then calculated by SPSS-X. This analysis determined that no significant difference existed between the means for each data element, meaning the cycle, or time, effect on unsegmented data elements was insignificant.

The final analysis on the unsegmented data elements employed a two-way analysis of variance, utilizing both firm type and cycle, in order to determine whether an interaction effect existed. The resulting analysis determined that both the main effects and the interaction effects of type and cycle on each of the unsegmented data elements were insignificant in explaining any differences.

D. ANALYSES OF VARIANCE FOR SEGMENTED DATA

The next three analyses of variance examine the segmented forms of the same data elements. A different configuration of the data was utilized for these, as presented in the

Appendix. This arrangement is only slightly varied from the
original data configuration utilized earlier, however, this
arrangement better facilitates examination of the possible
effects of segmenting upon the data elements. This
arrangement categorized data by firm name, firm type, cycle,
year, backlog, net sales, operating profits, identifiable
assets, and segments. Segment 1 includes defense data
elements, and Segment 2 includes commercial data elements.
Where data were unreliable or not available, a -1 was again
employed.

The following three analyses sought to determine whether
differences existed within the data elements, when separated
into defense and commercial segments. Table 4 contains the
significance of F for all of the following analyses of
variance, with all significant effects indicated by an
asterisk.

The first analysis utilized a one-way analysis of
variance by cycle alone. It was determined that significant
main effects by cycle existed for both defense sales and
defense profits. Defense sales had a significance of F of
.041, while for defense profits it was .030. Defense backlog
was nearly significant, with a significance of F of .058.
Cycle had an insignificant effect on the remainder of the
segmented data elements, which are listed in Table 4.

30

TABLE 4

ANALYSES OF VARIANCE FOR SEGMENTED DATA

ANOVA and Independent Variables	Data Elements	Sigf of F
One-Way by Cycle	DB; ME	.058
	CB; ME	.841
	DS; ME	.041 *
	CS; ME	.478
	DP; ME	.030 *
	CP; ME	.466
	DA; ME	.193
	CA; ME	.321
One-Way by Type	DB; ME	.029 *
	CB; ME	.652
	DS; ME	.007 *
	CS; ME	.004 *
	DP; ME	.025 *
	CP; ME	.023 *
	DA; ME	.038 *
	CA; ME	.224
Two-Way by Type, Cycle	DB; ME, T	.004 *
	DB; ME, C	.034 *
	DB; IE, T+C	.257
	CB; ME, T	.495
	CB; ME, C	.854
	CB; IE, T+C	.775
	DS; ME, T	.000 *
	DS; ME, C	.016 *
	DS; IE, T+C	.265
	CS; ME, T	.000 *
	CS; ME, C	.449
	CS; IE, T+C	.704
	DP; ME, T	.004 *
	DP; ME, C	.014 *
	DP; IE, T+C	.250
	CP; ME, T	.002 *

31

TABLE 4 (Continued)

ANOVA and Independent Variables	Data Elements	Sig of F
	CP; ME, C	.400
	CP; IE, T+C	.678
	DA; ME, T	.008 *
	DA; ME, C	.145
	DA; IE, T+C	.291
	CA; ME, T	.091
	CA; ME, C	.312
	CA; IE, T+C	.758

* = Significance of .05 or less

DB = Defense Backlog		ME = Main Effects	
CB = Commercial Backlog		IE = Interaction Effects	
DS = Defense Sales		T = Type	
CS = Commercial Sales		C = Cycle	
		S = Segment	
DP = Defense Profits			
CP = Commercial Profits			
DA = Defense Assets			
CA = Commercial Assets			

The next analysis was a one-way ANOVA by type of firm. This analysis determined that most of the segmented data elements displayed significant main effects by type. The significance of F for defense backlog was .029, defense sales was .007, commercial sales was .004, defense profits was .025, commercial profits was .023, and defense assets was

.038. Only commercial backlog and commercial assets displayed no significant type effect.

The final analysis of variance was a two-way ANOVA, by cycle and type. Type was found to be a significant main effect for 6 of the 8 segmented data elements, with the significance of F for each listed here. Defense backlog was .004, both defense and commercial sales were .000, defense profits was .004, commercial profits was .002, and defense assets was .008. These findings are consistent with the findings of the earlier one-way ANOVA by type.

The main effect of cycle was significant for three of the segmented data elements, including defense backlog with a significance of F of .034, defense sales with .016, and defense profits with .014.

None of the interaction effects of type and cycle were significant for any of the segmented data elements.

IV. SUMMARY AND CONCLUSIONS

The primary purpose of this study was to determine whether the analysis of differences in financial structure between DOD and non-DOD oriented corporations could be facilitated through the use of segmented data. An effective measure of profitability has yet to be established which accurately applies to DOD oriented corporations, as well as their commercially oriented counterparts, and this study sought to evaluate the effects of various influences on the basic data elements of backlogs, net sales, operating profits, and identifiable assets.

The general methodology utilized for derivation of the segmented data elements was discussed, and specific approaches outlined for each individual corporation.

The data elements were first analyzed in their unsegmented form. By employing analyses of variance, it was determined that neither the main effects of type of firm (DOD or non-DOD) or cycle (time periods), nor the interaction effects of both were significant for any of the data elements.

When these data elements were analyzed in their segmented form (defense and commercial) however, it became apparent that segmentation was a significant explainer of variations in the data elements.

34

The first segmented analysis utilized a one-way analysis of variance by cycle. This resulted in significant effects on both defense net sales and defense operating profits, and a somewhat significant effect on defense backlogs (.058 significance of F).

In the second one-way analysis of variance by type, it was determined that significant effects were apparent for several segmented data elements. These included defense backlogs, defense and commercial net sales, defense and commercial profits, and defense assets.

In the two-way ANOVA, utilizing both type and cycle, there were significant main effects for defense backlogs, defense net sales, and defense operating profits. None of the interaction effects were significant.

The significant findings for defense and commercial net sales was expected, since this was the factor used in the initial phase of the study to delineate DOD oriented and non-DOD oriented corporations. However, the significance of the other segmented data elements emphasizes the importance of this approach to understanding the inherent differences between the data elements of backlogs, net sales, operating profits, and identifiable assets.

Segment is a major factor in explaining of the variation present in the four data elements examined in this study, and it is more accurate in explaining the variation than is type.

APPENDIX

This appendix presents the SEC 10K data as utilized throughout the study. The data are arranged in the order employed by the SPSS-X program for the analyses of variance. The corporations are first listed below alphabetically, along with the corresponding abbreviations. On subsequent pages, the arrangement of data utilized by SPSS-X is presented.

Abbreviation	Corporation Name
BA	Boeing Co.
EMR	Emerson Electric Co.
FEN	Fairchild Industries, Inc.
FMC	FMC Corp.
GD	General Dynamics Corp.
GLD	Gould, Inc.
GQ	Grumman Corp.
HRS	Harris Corp.
HPC	Hercules, Inc.
HON	Honeywell, Inc.
LK	Lockheed Corp.
ML	Martin Marietta Corp.
MD	McDonnell Douglas Corp.
NOC	Northrop Corp.
RTN	Raytheon Co.
RCA	RCA Corp.
ROK	Rockwell International
SGN	The Signal Companies, Inc.
SMF	Singer Co.
SY	Sperry Corp.
TDY	Teledyne, Inc.
TXT	Textron, Inc.
TOD	Todd Shipyards Corp.
UTX	United Technologies Corp.

SPSS-X ARRANGEMENT OF SEC DATA

Firm	Type	Cycle	Year	Backlog	Sales	Profits	Assets	Segment
BA	1	2	84	7258	4469	477	1630	1
BA	1	2	83	6575	3664	384	1213	1
BA	1	2	82	4663	3310	365	1027	1
BA	1	2	81	4123	2354	262	925	1
BA	1	1	80	3670	1432	104	658	1
BA	1	1	79	2137	1471	56	533	1
BA	1	1	78	1516	1403	66	378	1
BA	1	1	77	1387	1367	78	357	1
EMR	1	2	84	720	481	71	184	1
EMR	1	2	83	715	423	68	145	1
EMR	1	2	82	-1	368	47	126	1
EMR	1	2	81	-1	288	32	123	1
EMR	1	1	80	-1	239	29	92	1
EMR	1	1	79	-1	199	24	78	1
EMR	1	1	78	-1	176	21	63	1
EMR	1	1	77	-1	146	17	41	1
FEN	2	2	84	456	345	38	190	1
FEN	2	2	83	374	399	61	177	1
FEN	2	2	82	522	548	56	172	1
FEN	2	2	81	715	636	54	190	1
FEN	2	1	80	832	582	62	141	1
FEN	2	1	79	763	493	57	130	1
FEN	2	1	78	763	401	46	136	1
FEN	2	1	77	935	295	36	162	1
FMC	1	2	84	2038	1414	191	356	1
FMC	1	2	83	2093	1320	131	284	1
FMC	1	2	82	2237	1018	83	322	1
FMC	1	2	81	2020	582	53	281	1
FMC	1	1	80	1229	651	81	202	1
FMC	1	1	79	744	525	64	173	1
FMC	1	1	78	763	500	51	127	1
FMC	1	1	77	716	348	45	121	1
GD	2	2	84	18231	6707	592	1757	1
GD	2	2	83	13358	6339	445	1616	1
GD	2	2	82	11496	5375	263	1576	1
GD	2	2	81	6704	3893	223	1079	1
GD	2	1	80	7114	3419	197	1055	1
GD	2	1	79	7889	2613	135	855	1
GD	2	1	78	7141	1982	-247	698	1
GD	2	1	77	4190	1842	116	790	1
GLD	1	2	84	645	395	-1	-1	1
GLD	1	2	83	694	348	-1	-1	1
GLD	1	2	82	613	297	-1	-1	1
GLD	1	2	81	691	263	-1	-1	1
GLD	1	1	80	639	239	-1	-1	1

37

Firm	Type	Cycle	Year	Backlog	Sales	Profits	Assets	Segment
GLD	1	1	79	692	216	-1	-1	1
GLD	1	1	78	829	187	-1	-1	1
GLD	1	1	77	682	113	-1	-1	1
GQ	2	2	84	4682	2351	169	860	1
GQ	2	2	83	4032	2046	165	788	1
GQ	2	2	82	3013	1804	169	723	1
GQ	2	2	81	2912	1541	170	672	1
GQ	2	1	80	2191	1293	106	513	1
GQ	2	1	79	1870	1167	91	418	1
GQ	2	1	78	1755	1218	76	315	1
GQ	2	1	77	1607	1262	67	315	1
HRS	1	2	84	423	630	51	264	1
HRS	1	2	83	328	529	44	188	1
HRS	1	2	82	236	399	41	171	1
HRS	1	2	81	195	307	30	128	1
HRS	1	1	80	150	263	26	98	1
HRS	1	1	79	150	218	23	84	1
HRS	1	1	78	140	190	21	67	1
HRS	1	1	77	125	148	12	54	1
HPC	1	2	84	1500	531	81	356	1
HPC	1	2	83	1400	375	62	289	1
HPC	1	2	82	690	320	61	241	1
HPC	1	2	81	0	313	42	143	1
HPC	1	1	80	0	266	23	125	1
HPC	1	1	79	0	189	12	101	1
HPC	1	1	78	0	136	23	98	1
HPC	1	1	77	0	110	11	81	1
HON	1	2	84	4126	1433	-1	-1	1
HON	1	2	83	3908	1275	-1	-1	1
HON	1	2	82	3404	1044	-1	-1	1
HON	1	2	81	3526	949	-1	-1	1
HON	1	1	80	3213	832	-1	-1	1
HON	1	1	79	2756	672	-1	-1	1
HON	1	1	78	2208	586	-1	-1	1
HON	1	1	77	1799	503	-1	-1	1
LK	2	2	84	9246	7693	-1	-1	1
LK	2	2	83	7657	6186	-1	-1	1
LK	2	2	82	5412	5413	-1	-1	1
LK	2	2	81	4884	4919	-1	-1	1
LK	2	1	80	4075	4193	-1	-1	1
LK	2	1	79	3827	3287	-1	-1	1
LK	2	1	78	3466	3000	-1	-1	1
LK	2	1	77	2735	2819	-1	-1	1
ML	2	2	84	6200	2978	222	718	1
ML	2	2	83	4589	2503	192	565	1

SPSS-X ARRANGEMENT OF SEC DATA (Continued)

Firm	Type	Cycle	Year	Backlog	Sales	Profits	Assets	Segment
ML	2	2	82	3534	2218	156	481	1
ML	2	2	81	2674	1732	113	353	1
ML	2	1	80	2627	1114	81	265	1
ML	2	1	79	1481	799	67	243	1
ML	2	1	78	816	703	54	248	1
ML	2	1	77	750	576	54	198	1
MD	2	2	84	10602	6778	519	8473	1
MD	2	2	83	8055	5791	474	5760	1
MD	2	2	82	8984	5405	366	5113	1
MD	2	2	81	7321	4632	328	3445	1
MD	2	1	80	5878	3563	247	2529	1
MD	2	1	79	3465	3141	287	1906	1
MD	2	1	78	2955	3050	290	1665	1
MD	2	1	77	3002	2723	259	1534	1
NOC	2	2	84	3347	3105	-1	-1	1
NOC	2	2	83	2431	2636	-1	-1	1
NOC	2	2	82	2303	1873	-1	-1	1
NOC	2	2	81	1799	1522	-1	-1	1
NOC	2	1	80	1605	1187	-1	-1	1
NOC	2	1	79	1302	1119	-1	-1	1
NOC	2	1	78	849	1451	-1	-1	1
NOC	2	1	77	1487	1307	-1	-1	1
RTN	2	2	84	4084	2959	-1	-1	1
RTN	2	2	83	3748	2614	-1	-1	1
RTN	2	2	82	3178	2160	-1	-1	1
RTN	2	2	81	2166	1946	-1	-1	1
RTN	2	1	80	1977	1649	-1	-1	1
RTN	2	1	79	1504	1500	-1	-1	1
RTN	2	1	78	1660	1194	-1	-1	1
RTN	2	1	77	1518	1038	-1	-1	1
RCA	1	2	84	1552	1442	105	441	1
RCA	1	2	83	1220	1299	96	285	1
RCA	1	2	82	1239	1048	80	266	1
RCA	1	2	81	895	896	65	198	1
RCA	1	1	80	757	768	51	182	1
RCA	1	1	79	532	660	40	165	1
RCA	1	1	78	574	522	25	113	1
RCA	1	1	77	427	440	21	73	1
ROK	2	2	84	5280	6591	601	2712	1
ROK	2	2	83	3360	5883	531	2315	1
ROK	2	2	82	2450	4839	413	2103	1
ROK	2	2	81	1290	4071	314	1811	1
ROK	2	1	80	1090	3738	271	1711	1
ROK	2	1	79	955	3155	251	1401	1
ROK	2	1	78	1030	2716	194	1126	1

Firm	Type	Cycle	Year	Backlog	Sales	Profits	Assets	Segment
ROK	2	1	77	1100	3098	153	-1	1
SGN	1	2	84	1096	791	-1	-1	1
SGN	1	2	83	908	932	-1	-1	1
SGN	1	2	82	741	605	-1	-1	1
SGN	1	2	81	670	473	-1	-1	1
SGN	1	1	80	562	410	-1	-1	1
SGN	1	1	79	462	347	-1	-1	1
SGN	1	1	78	331	293	-1	-1	1
SGN	1	1	77	265	259	-1	-1	1
SMF	1	2	84	1200	1111	78	572	1
SMF	1	2	83	1000	1011	68	477	1
SMF	1	2	82	1000	892	56	388	1
SMF	1	2	81	1000	781	45	326	1
SMF	1	1	80	876	663	36	283	1
SMF	1	1	79	580	520	27	231	1
SMF	1	1	78	525	462	31	203	1
SMF	1	1	77	470	380	27	168	1
SY	1	2	84	1508	1365	-1	-1	1
SY	1	2	83	1367	1161	-1	-1	1
SY	1	2	82	1010	991	-1	-1	1
SY	1	2	81	771	907	-1	-1	1
SY	1	1	80	702	757	-1	-1	1
SY	1	1	79	633	649	-1	-1	1
SY	1	1	78	603	584	-1	-1	1
SY	1	1	77	550	556	-1	-1	1
TDY	1	2	84	-1	1170	134	295	1
TDY	1	2	83	-1	1111	127	300	1
TDY	1	2	82	-1	934	112	225	1
TDY	1	2	81	-1	788	113	197	1
TDY	1	1	80	-1	673	86	179	1
TDY	1	1	79	-1	584	83	152	1
TDY	1	1	78	-1	548	73	145	1
TDY	1	1	77	-1	533	68	125	1
TXT	1	2	84	601	746	69	565	1
TXT	1	2	83	469	656	84	440	1
TXT	1	2	82	449	592	88	422	1
TXT	1	2	81	464	496	112	327	1
TXT	1	1	80	307	429	110	245	1
TXT	1	1	79	358	327	105	187	1
TXT	1	1	78	442	368	89	132	1
TXT	1	1	77	168	319	79	108	1
TOD	2	2	84	600	558	-1	-1	1
TOD	2	2	83	900	701	-1	-1	1
TOD	2	2	82	1300	604	-1	-1	1
TOD	2	2	81	1300	500	-1	-1	1

40

SPSS-X ARRANGEMENT OF SEC DATA (Continued)

Firm	Type	Cycle	Year	Backlog	Sales	Profits	Assets	Segment
TOD	2	1	80	1200	400	-1	-1	1
TOD	2	1	79	1400	284	-1	-1	1
TOD	2	1	78	1000	159	-1	-1	1
TOD	2	1	77	950	138	-1	-1	1
UTX	1	2	84	4910	4440	-1	-1	1
UTX	1	2	83	4903	4556	-1	-1	1
UTX	1	2	82	5111	4304	-1	-1	1
UTX	1	2	81	4548	3665	-1	-1	1
UTX	1	1	80	4215	2625	-1	-1	1
UTX	1	1	79	3722	2000	-1	-1	1
UTX	1	1	78	3917	1639	-1	-1	1
UTX	1	1	77	2890	1646	-1	-1	1

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